From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

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SUISSE

19 NOV. 2001

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Rule 71.1)

Applicant's or agent's file reference NO 6000/WO	Date of mailing *(day/month/year)* 16.11.2001 **IMPORTANT NOTIFICATION**

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/EP00/08731	07/09/2000	13/09/1999

Applicant
SOCIETE DES PRODUITS NESTLE S.A. et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Nam and mailing address of the IPEA/	Authorized officer
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Hundt, D Tel.+49 89 2399-8042

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
NO 6000/WO		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/EP00/08731	07/09/2000	13/09/1999
International Patent Classification (IPC) or national classification and IPC A61K31/23		
Applicant SOCIETE DES PRODUITS NESTLE S.A. et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 1 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

Dat of submission of the demand	Date of completion of this report
09/04/2001	16.11.2001
Name and mailing address of the international preliminary examining authority: Europ an Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Cattell, James Telephone No. +49 89 2399 8468

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP00/08731

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

1-14	as originally filed			

Claims, No.:

1-8	as received on	08/10/2001	with letter of	08/10/2001

Drawings, sheets:

1/13-13/13	as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   - ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
   - ☐ the language of publication of the international application (under Rule 48.3(b)).
   - ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   - ☐ contained in the international application in written form.
   - ☐ filed together with the international application in computer readable form.
   - ☐ furnished subsequently to this Authority in written form.
   - ☐ furnished subsequently to this Authority in computer readable form.
   - ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
   - ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   - ☐ the description, pages:
   - ☐ the claims, Nos.:

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	
	No:	Claims	1-8
Inventive step (IS)	Yes:	Claims	
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-8
	No:	Claims	

2. Citations and explanations
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

1). Many natural oil, olive oil for example, can be used as a "functional food". Hence such oils would fall within the scope of claim 3 under Article 33(2) PCT.

2). Document D1 (EP-A-0,852,913) describes on page 3, lines 10 to 14 a medicament containing a lipid providing 35-50% of the energy for the treatment of inflammatory gastro intestinal disorders. The lipid may be 30-70% MCT (page 3 line 56).
This disclosure falls within the scope of claims 3 and 4 under Article 33(2) PCT.

3). Document D2 (EP-A-0,687,418) discloses in claim 3 a lipid composition with a 1:1 ratio of n-3 to n-6 lipids and 60% MCT to treat sepsis. D2, page 3 line 11 states that the oil can be administered alone, i.e. providing 100% of the total energy for the composition. This use falls within the scope of claims 1, 2, 3, 4, and 5 under Article 33(3) PCT.

Document D3 (WO 94/15464) discloses in claim 10 a lipid composition for the treatment of sepsis falling within the scope of claims 1, 2 and 3 under Article 33(2) PCT. (In a composition of pure triglyceride, 100% of the energy is provided by the lipid).

Document D4 (EP-A-0,611,568) discloses on page 3 **compositions** of α linolenic acid, EPA and DHA with ratios of n-3 to n-6 of 1:2.3, and 40-65% of the energy being provided by the lipid (page 4 line 15), for the treatment of tumour patients. This composition falls within the scope of claims 3, 4, 5, 6, 7 and 8 under Article 33(2) PCT.

Document D5 (US 5,723,446) discloses a **composition** with 45% of the energy being provided by a lipid (col. 3 line 50) with a n-3 to n-6 ratio of 1:2 (col. 3 line 61) including EPA and DHA (col. 4). This composition falls within the scope of claims 3, 5, 6, 7 and 8 under Article 33(2) PCT.

VIII.

3). For the assessment of the present claim 2 on the question whether it is industrially applicable, no unified criteria exist in the PCT Contracting States. The patentability can also be dependent upon the formulation of the claims. The EPO, for example, does not recognize as industrially applicable the subject-matter of claims to the use of a compound in medical treatment, but may allow, however, claims to a known compound for first use in medical treatment and the use of such a compound for the manufacture of a medicament for a new medical treatment.

Claims.

1. Use of a composition, which comprises at least one lipid wherein the lipid provides greater than 35% total energy of the composition for use in the manufacture of a medicament, functional food or nutritive product for the treatment or prevention of sepsis or inflammatory shock.

2. A method of treatment or prevention of sepsis or inflammatory shock which comprises administering an effective amount of a composition, which comprises at least one lipid wherein the lipid provides greater than 35% total energy of the composition.

3. A method of producing a composition which comprises at least one lipid wherein the lipid provides greater than 35% total energy of the composition, having the steps of blending the constituents, liquefying the blended mixture and homogenising.

4. A composition for use as a medicament, functional food or nutrative product, which comprises at least one lipid wherein the lipid provides greater than 35% total energy of the composition, which further comprises about 25% to about 70% MCT (medium chain triglycerides) by weight of total lipid and less than about 15% by weight saturated fatty acids excluding MCT.

5. A composition according to claim 4, which comprises a n-6/n-3 fatty acid ratio of about 2/1 to 7/1.

6. A composition according to claim 4 or 5, which comprises at least one n-3 fatty acid selected from α-linolenic acid, EPA, DPA or DHA.

7. A composition according to any of claim 4 to 6, which comprises at least one n-6 fatty acid selected from linoleic acid (18:2,n-6), γ-linolenic acid (18:3, n-6), dihomo-γ-linoleinic acid (18:4, n-6) or arachidonic acid (20:4, n-6).

8. A composition according to any of claim 4 to 7 for enteral administration which comprises an acceptable carrier, diluent or adjuvant.

PATENT COOPERATION TREATY

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INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION** see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
NO 6000/WO		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
~~PCT/EP 00/08731~~	~~07/09/2000~~	~~13/09/1999~~
Applicant		
SOCIETE DES PRODUITS NESTLE S.A. et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language,** the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   [ ] contained in the international application in written form.

   [ ] filed together with the international application in computer readable form.

   [ ] furnished subsequently to this Authority in written form.

   [ ] furnished subsequently to this Authority in computer readble form.

   [ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   [ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of invention is lacking** (see Box II).

4. With regard to the **title,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

   [ ] as suggested by the applicant.

   [ ] because the applicant failed to suggest a figure.

   [ ] because this figure better characterizes the invention.

   [X] None of the figures.

INTERNATIONAL SEARCH REPORT

Inte[redacted]pplication No
PCT/EP 00/08731

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61K31/23 A23L1/30 A61P3/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61K A23L A61P

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ, WPI Data, BIOSIS, CHEM ABS Data, EMBASE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 687 418 A (CLINTEC NUTRITION) 20 December 1995 (1995-12-20) claims 1-5,9,10 page 3, line 20,21 page 3, line 58 -page 4, line 4 ---	1-3,7-10
X	WO 94 15464 A (ABBOTT LABORATORIES) 21 July 1994 (1994-07-21) claims 1-6,10,12,17 page 12, paragraphs 3,4 ---	1-10
X	EP 0 852 913 A (SOCIETE DES PRODUITS NESTLE) 15 July 1998 (1998-07-15) claims 1,5,7 page 2, line 56 -page 3, line 3 page 3, line 49 -page 4, line 5 --- -/--	1-4,7-10

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 February 2001	06/03/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Peeters, J

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Inte[illegible]pplication No
PCT/EP 00/08731

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 723 446 A (D.GRAY E.A.) 3 March 1998 (1998-03-03) table 1 column 3, line 53 -column 4, line 13 column 5, line 64 -column 6, line 4	1-3,5-10
X	EP 0 611 568 A (FRESENIUS) 24 August 1994 (1994-08-24) claims 1,10,11	1-8

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int. Application No
PCT/EP 00/08731

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 687418 A	20-12-1995	US 5574065 A	12-11-1996
		CA 2147302 A	22-10-1995
		US 5700837 A	23-12-1997
WO 9415464 A	21-07-1994	AU 5995294 A	15-08-1994
		CA 2151820 A	21-07-1994
		DE 69420124 D	23-09-1999
		DE 69420124 T	02-03-2000
		EP 0679057 A	02-11-1995
		ES 2136189 T	16-11-1999
		US 5661180 A	26-08-1997
		US 5962712 A	05-10-1999
EP 852913 A	15-07-1998	AU 5182698 A	16-07-1998
		CA 2223198 A	14-07-1998
		JP 10203996 A	04-08-1998
		US 5952295 A	14-09-1999
US 5723446 A	03-03-1998	NONE	
EP 611568 A	24-08-1994	DE 4304394 A	02-09-1993
		FI 940629 A	14-08-1994
		NO 940236 A	15-08-1994

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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International Bureau

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22 March 2001 (22.03.2001)

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WO 01/19356 A2

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7 September 2000 (07.09.2000)

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(30) Priority Data:
99118173.6 13 September 1999 (13.09.1999) EP

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(74) Agent: **LOCK, Graham**; 55, avenue Nestlé, CH-1800 Vevey (CH).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *Without international search report and to be republished upon receipt of that report.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 01/19356 A2

(54) Title: HIGH LIPID DIET

(57) Abstract: A composition for use as a medicament or nutritional product is described which comprises at least one lipid wherein the lipid provides greater than 35 % total energy of the composition. A prefered embodiment comprises a n-6/n-3 fatty acid ratio of about 2/1 to 7/1. In addition, a method of preparing the composition; use of the composition in the manufacture of a medicament or nutritional product; and a method of treatment or prevention of sepsis or inflammatory shock which comprises administering an effective amount of the composition are described.

High Lipid Diet

The present invention relates to a composition for use as a medicament, functional food or nutrative product which comprises a high lipid content, a method of preparing the composition; use of the composition in the manufacture of a medicament, functional food or nutritional product; and a method of treatment or prevention of sepsis or inflammatory shock which comprises administering an effective amount of the composition.

Within the context of this specification the word "comprises" is taken to mean "includes, among other things". It is not intended to be construed as "consists of only".

The abbreviation EPA represents eicosapentaenoic acid (20:5,n-3); DPA represents docosapentaenoic acid (22:5,n-3); DHA represents docosahexaenoic acid (22:6,n-3); MCT represents medium chain triglycerides and LC-PUFA represents long chain polyunsaturated fatty acid.

It is generally recommended that a diet contains a lipid content which provides about 30% total energy of the diet for a normal healthy individual.

Conventional diets are generally high in saturated fat and have a high ratio of n-6/n-3 fatty acids. A problem with consuming this type of diet is that saturated fat is implicated in cardiovascular disease and cancer. In addition, a high ratio of n-6/n-3 fatty acids is implicated in inflammatory disorders. Furthermore, it is well known that patients having chronic intestinal inflammation are at risk of developing certain types of cancer.

The quantity and quality of lipids for critically ill patients at risk of developing infectious and septic complications is a matter of debate. It has now been found that the quantity of lipids is important for clinical outcome, in particular for limiting body weight and muscle mass losses as well as for normalising the levels of proteins produced in the acute phase of septic shock. This provides support for maintaining a high lipid content in enteral products destined for critically ill patients.

Remarkably, it has now been found that a composition which comprises a high lipid content has good effects on recovery or prevention of sepsis or inflammatory shock. This is unexpected because lipids in the diet are thought to be not well metabolised during sepsis or inflammatory shock since it is well known that sepsis induces hypertriglyceridemia.

Furthermore, it has now been found that compositions having specific fatty acid profiles have particularly good effects.

Suprisingly, results now obtained show:

Enteral diets with a high lipid content have beneficial effect on the recovery from an acute inflammatory stress (acute phase protein concentration) but also on clinical parameters (body weight loss and nitrogen excretion).

The beneficial effect of a high lipid diet is observed when lipid level is increased after the induction of stress (curative effect) but is also pronounced when a high lipid diet is given from one week before the stress.

Accordingly, in a first aspect the invention provides a composition for use as a medicament, functional food or nutrative product which comprises at least one lipid wherein the lipid provides greater than 35% total energy of the composition.

In a second aspect, the invention provides a method of producing a composition according to the invention having the steps of blending the constituents, liquefying the blended mixture and homogenising.

In a third aspect the invention provides the use of a composition which comprises a lipid content that provides greater than 35% total energy of the composition in the manufacture of a medicament, functional food or nutritive product for the treatment or prevention of sepsis or inflammatory shock.

In a forth aspect the invention provides a method of treatment or prevention of sepsis or inflammatory shock which comprises administering an effective amount of a composition which comprises a lipid content which provides greater than 35% total energy of the composition.

Preferably a composition according to an embodiment of the invention comprises lipid wherein the lipid content provides a lower limit of about 40%, more preferably about 50% and/or an upper limit of about 75%, more preferably about 60% total energy of the composition.

Preferably a composition according to an embodiment of the invention comprises a composition which comprises MCT (medium chain triglycerides). More preferably a composition according to an embodiment of the invention comprises about 25% to about 70% MCT by weight of total lipid. Even more preferably a composition according to an embodiment of the invention comprises about 40% to about 60% MCT by weight of total lipid.

More preferably a composition according to an embodiment of the invention comprises low levels of saturated fatty acids excluding MCT. Preferably the composition comprises less than about 15% by weight saturated fatty acids excluding MCT.

Preferably, an embodiment of a composition according to the invention comprises a low n-6/n-3 fatty acid ratio. More preferably the ratio is about 2/1 to 7/1, even more preferably the ratio is about 2/1 to 5/1.

Preferably, an embodiment of a composition according to the invention comprises about 3% to about 5% of total lipids of at least one n-3 fatty acid selected from α-linolenic acid, EPA, DPA,or DHA derived from any source. More preferably a composition according to an embodiment of the invention comprises α-linolenic acid.

Preferably, an embodiment of a composition according to the invention comprises at least one n-6 fatty acid. Preferably it is selected from linoleic acid (18:2, n-6), γ-linolenic acid (18:3, n-6), dihomo-γ-linoleinic acid (18:4, n-6) or arachidonic acid (20:4, n-6). More preferably, it is selected from the group which comprises linoleic acid (18:2, n-6) and γ-linolenic acid (18:3, n-6). Most preferably it is linoleic acid (18:2, n-6).

Preferably the fatty acid or lipid source is selected from the group comprising natural oils, single cell oils, structured lipids and synthetic oils. Preferable sources of fats or lipids are olive oil, corn oil, sunflower oil, rapeseed oil, corn oil, hazelnut oil, safflower oil, canola oil, fish oil, milk fat, soya or the like. Fractionated coconut oils are a preferable source of medium chain triglycerides. A mixture of soybean oil, canola or olive oil, and MCT may be used.

Preferably a dose of about 0.5 to about 2.5 litres of the composition is provided per day. More preferably the dose is about 1.5 to 2 litres per day. Of course the exact dose would depend on the patient condition and status.

Preferably, a composition according to an embodiment of the invention is in a form suitable for enteral administration. Preferably it comprises an acceptable carrier, diluent or adjuvant.

Preferably an embodiment of the composition includes a protein source, a carbohydrate source and a lipid source.

Preferably, the protein source is a high quality protein source; for example milk protein, whey protein, casein protein, or soy protein, or mixtures of these

proteins. The protein source may be in the form of intact protein or may be hydrolysed. Other protein sources such as rice, pea and oat protein, or mixtures thereof, may also be used. Further, if desired, the protein source may include free amino acids.

Preferably the protein source provides about 10% to about 25% of the energy of the composition. For example, the protein source may provide about 12% to about 18% of the energy of the composition; preferably about 15% of the energy of the composition.

The carbohydrate source may be any suitable carbohydrate or carbohydrate mixture. For example, the carbohydrate source may be maltodextrin, modified starch, amylose starch, tapioca starch, corn starch, or fructose, or mixtures thereof. Maltodextrin is preferred if low osmolarity is required.

Preferably the carbohydrate source provides about 12% to about 55% of the energy of the composition; preferably about 25% to about 45% of the energy. For example, the carbohydrate source may provide about 40% of the energy of the composition.

Preferably an embodiment of the composition includes a complete vitamin and mineral profile. For example, sufficient vitamins and minerals may be provided to supply about 25% to about 250% of the recommended daily allowance of the vitamins and minerals per 1000 calories of the nutritional composition. In addition, the composition preferably has an osmolarity of about 200 mOsm/l to about 400 mOsm/l; for example about 250 mOsm/l to about 350 mOsm/l. Furthermore, the energy density of the composition is preferably about 700 kcal/l to about 1500 kcal/l; for example about 1000 kcal/l.

Preferably an embodiment of the composition is in the form of a ready-to-use formulation. In this form, the composition may be fed to a patient via a nasogastric tube, jejunum tube or by having the patient drink it. As such, the composition may be in a variety of forms; for example as a fruit juice-type beverage, a milk shake-type beverage or the like. In an alternative embodiment the composition is preferably in soluble powder form for reconstitution prior to use.

Preferably, an embodiment of the composition includes a flavour, sweetener or other additive. An artificial sweetener such as acetosulfame or an L-aspartyl based sweetener may be used; for example aspartame.

Preferably, an embodiment of the composition is produced according to a conventional method; for example, by blending together the protein source, a carbohydrate source, and a lipid source. Emulsifiers may be included in the blend. Vitamins and/or minerals may be added, but are usually added later to avoid thermal degradation. Lipophilic vitamins, emulsifiers or the like may be dissolved into the lipid source prior to blending. Water, preferably water which has been subjected to reverse osmosis, may be mixed in to form a liquid mixture. The temperature of the water is preferably about 50°C to about 80°C to aid dispersal of the ingredients. Commercially available liquefiers may be used to form the liquid mixture.

The liquid mixture may be thermally treated to reduce bacterial loads. For example, the liquid mixture may be rapidly heated to a temperature in the range of about 80°C to about 110°C for about 5 seconds to about 5 minutes. This may be carried out by steam injection or by heat exchanger; for example a plate heat exchanger.

Preferably the liquid mixture is cooled to about 60°C to about 85°C; for example by flash cooling. The liquid mixture may be homogenised; for example in two stages at about 7 MPa to about 40 MPa in the first stage and about 2 MPa to about 14 MPa in the second stage. The homogenised mixture may be further cooled to add any heat sensitive components; such as vitamins and minerals. The pH and/or solids content of the homogenised mixture is conveniently standardised.

To produce a liquid product, the homogenised mixture is preferably aseptically filled into suitable containers. Aseptic filling of the containers may be carried out by pre-heating the homogenised mixture (for example to about 75 to about 85°C) and injecting steam into the homogenised mixture to raise the temperature to about 140 to about 160°C; for example at about 150°C. The homogenised mixture may be cooled, for example by flash cooling, to a temperature of about 75 to about 85°C. The homogenised mixture may be further homogenised,

cooled to about room temperature and filled into containers. Suitable apparatus for carrying out aseptic filling of this nature is commercially available.

To produce a powder product, the homogenised mixture is preferably dried to powder; for example by spray drying. Preferably, conventional procedures are used.

Preferably, an embodiment of the composition in liquid form is administered by tube feeding, by gravity, or pump. In this form, the composition preferably has a viscosity of less than about 12 cp at room temperature.

Preferably an embodiment of the composition is suitable for clinical use, for example as a nutritional support for human or animal patients; particularly patients requiring long term nutritional support. Furthermore, the composition is preferably suitable for patients with normal digestive function.

It will be appreciated that the composition may be in a form other than that suitable for clinical nutrition. For example, the composition may be in the form of a dessert, cereal, yoghurt, snack bar, or the like. If fed to pets, the enteral composition may be in the form of dried kibble, meat emulsion, or formulated emulsion.

Specific embodiments of the invention will now be described in detail with reference to the accompanying drawings in which:

Figure 1 shows the results, in rats, of measurements of growth before infection.

Figure 2 shows results of food conversion efficiency which was 35% lower with a 35% lipid diet in rats than with a 15% lipid diet in rats.

Figure 3 shows the results of rat weight changes post-infection.

Figure 4 shows the results of cumulative nitrogen excretion in rat urine for 6 days after infection.

Figure 5 shows the results of experiments investigating the effect of a high lipid diet on rat spleen weight.

Figures 6 and 7, from two independent studies, show the results of effects on rat white blood cells.

Figures 8 and 9, from two independent studies, show the results of effects on rat orosomucoid plasma levels.

Figures 10 and 11, from two independent studies, show the results of effects on rat albumin plasma levels.

Figure 12 shows the results of effects of dietary lipid levels on rat triglyceride plasma levels.

Figure 13 shows results of rat body weight change post-infection; this figure is part of example 2.

Example 1

This example relates to the amount of lipid in the diet.

Remarkably it has now been found that there is a beneficial amount and profile of lipid in the diet, particularly in enteral products for critically ill patients. The effect of a high lipid diet in cases of acute stress has now been studied.

An animal model of sepsis in rats has now been used which permits testing of diets on the recovery from a condition representative of inflammatory syndromes observed in different clinical situations (see Breuille et al, Infection and Immunity, 67, 1079-1085, (1999)). It is important to note that the diets exemplified in rats must be correlated to diets for other mammals, for example humans. For example, a high lipid diet for a rat includes 35% of calories from lipids whereas a high lipid diet for a human includes at least about 35% to about 100% calories from lipids.

Two experiments, labeled Experiment 1 (Expt 1) and Experiment 2 (Expt 2) respectively, were carried out to assess the recovery of rats from sepsis when they were enterally fed with diets containing either 15% or 35% of calories as lipids. The second amount corresponds to more than twice the amount of lipid that rats usually have in their laboratory diet.

In the first experiment, rats received either a 15% or 35% lipid diet throughout the Experiment, i.e. 6 days prior to infection and 10 days post-infection.

In the second experiment, all rats received a 15% lipid diet during a preinfection period and were then randomly divided to continue either with a 15% diet post-infection or a high 35% lipid diet. Beneficial effects of the high lipid diet on different parameters were observed in response to infection: remarkably,

parameters measured returned to normal values faster with the high (35%) lipid diet compared to the low (15%) lipid diet.

In the first experiment the diets set out below were used:

High lipid diet (lipids at 35% of energy)

Parameter	Unit	Specification	Analysed
Energy	Kcal/100 ml	100	
Proteins	G/100 ml	3.75	
Lipids	G/100 ml	3.9	
Carbohydrates	G/100 ml	12.5	
Fatty acid pattern			
C14:0	% of total FA	Not fixed	0.3
C16:0	% of total FA	Not fixed	13
C18:0	% of total FA	Not fixed	6.4
C18:1 n-9	% of total FA	Not fixed	20
C18:2 n-6	% of total FA	Not fixed	54
C18:3 n-3	% of total FA	Not fixed	4.8

Low lipid diet (lipids at 15% of energy)

Parameter	Unit	Specification	Analysed
Energy	Kcal/100 ml	100	
Proteins	G/100 ml	3.75	
Lipids	G/100 ml	1.67	
Carbohydrates	G/100 ml	17.5	

The fatty acid composition of the low lipid diet was similar to the high lipid diet.

Diets were perfused continuously in the stomach. Four groups of animals were studied (n=11 in each group, at reception and inclusion of animals). (1)INF 15 group: infected animals . These rats received the 15% lipid diet (lipid = soybean oil) before and after infection. (2) PF 15 group: pair-fed animals of INF 15 (sham-infected with saline). These rats received the 15% lipid diet (lipid = soybean oil) before and after infection. (3) INF 35 group: infected animals . These rats received the 35% lipid diet (lipid = soybean oil) before and after

infection. (4) PF 35 group: pair-fed controls of INF 35 (sham-infection with saline). These rats received the 35% lipid diet (lipid = soybean oil) before and after infection.

All enteral products were isonitrogenous and isocaloric. They only differed in their relative content in lipids/carbohydrates. For technical reasons, proteins were provided in form of peptides since whole protein diets involved catheter obstruction issues.

To induce sepsis animals were infected by intravenous injection (via a tail vein) of 0.5ml of an E.coli suspension with a theoretic content of $1.0x10^9$ bacteria/ml.

After injection of bacteria or saline solution, enteral nutrition was progressively reintroduced..

In the second Experiment the same batches of diets as used in the first Experiment were used. Differences between the first Experiment and the second Experiment protocols were the following :

1) C (n=6) : control animals received the 15% lipid diet (lipid = soybean oil)
2) INF 15 : infected animals . These rats received the 15% lipid diet for the whole of the second Experiment.
3) PF 15 : pair-fed animals of INF 15 (sham-infection with saline).
4) INF 35 : infected animals . These rats received the 15% lipid diet before infection and the 35% lipid diet after infection in the second Experiment.
5) PF 35 : pair-fed controls of INF 35 (sham-infection with saline).
6) Rate of refeeding after infection was slightly higher than in the first Experiment (additional 10% on each day).

Body Weight before Infection:

The overall trend of the first Experiment can be visualized as a straight line (see figure 1). It is clear that the two groups start to show different weight gains after day 3: animals fed with the 15% lipid diet exhibited a better growth than with the 35% diet. This clearly confirms that in healthy rats, high lipid diets are not recommended and that for healthy rats 15% of total calories in the form of lipids provides a better diet than 35% of total calories in the form of lipids.

Body weight change after Infection :

Body weight changes were similar in both groups and in both experiments. Body weight loss paralleled the food intake curve. Therefore, after the initial body

weight loss, there was a progressive growth recovery as soon as food intake reached 50% of the ad libitum food intake.

The results show that the differences between INF 15% and INF 35% change after 6 days: before day 6 , the values for INF 35% are greater than INF 15%, but after day 6, there is a trend for a change. Therefore, there is a smaller body weight loss at the onset of infection that can be interpreted as a response of the organism to a high lipid diet. However no difference was observed in the second experiment, suggesting that the beneficial effect is more pronounced if the diet has been enriched with lipid before infection.

The results of the 2 experiments taken together lead to the important conclusion that a high lipid diet limits body weight loss. Furthermore, it is particularly effective if the diet has been enriched with lipid before infection.

Urinary nitrogen excretion :

It is interesting to observe nitrogen excretion at the same time as body weight changes since increased protein catabolism is known to be reflected in muscle atrophy and body weight loss. Indeed, increased proteolysis is generally associated with increased nitrogen excretion in urine.

Trends of urinary nitrogen excretion are in contrast when one looks at infected animals and their pair fed controls. After infection, INF rats (particularly those with 15% lipid diet) increase their urinary excretion until day 2, then level off their values (this is observed in both experiments). The opposite can be observed for both PF groups.

In the first Expt, there was a tendency for a smaller daily nitrogen excretion of INF35 compared to INF15. This trend was observed on each day. Pair-wise differences between infected and pair fed animals show that infected animals lost more nitrogen. This effect was more pronounced in the 15% formula than in the 35% one and differences between INF15 and INF35 were significant on days 2 and 3 after infection.

The same beneficial effect of the 35% formula was confirmed when urinary nitrogen was expressed as cumulative excretion from day 0 to day 6 postinfection ($p<0.05$), see fig 4.

In the second Experiment, the limitation of nitrogen loss was also observed with the high lipid diet on day 2 and 3 after infection ($p<0.05$).

The results lead to the conclusion that a high lipid diet has a beneficial effect for limitation of nitrogen loss induced by sepsis, suggesting a potential decrease of muscle proteolysis (which is dramatically increased in acute inflammatory conditions).

Tissue Weight:

High lipid diets have been shown to be beneficial for limitation of muscle atrophy and for return of spleen weight to a normal value.

White Blood Cell Counts:

High lipid diets have been shown to be beneficial for acceleration of normalisation of white blood cell counts.

Protein Concentrations In Plasma:

Proteins produced in the acute phase of sepsis exhibit changes in their concentration during inflammation. A high lipid content in the diet has been shown to accelerate the normalisation of accute phase protein concentration. This has been observed for positive and negative accute phase proteins.

Example 2

This example relates to the profile of lipids in the diet.

Whereas Example 1 shows the results and conclusions of providing a diet high in lipid content, Example 2 is directed to the the qualitative effects of dietary fatty acids on inflammatory parameters. The same rat model of sepsis and the same bacterial suspension was used.

The following table summarises the fatty acid composition of the diet formulations.

Table 6

	Diet A	Diet B	Diet C	Diet D	Diet E
Source	Soja Olive oil MCT	Soja Canola oil MCT	Olive oil Fish oil MCT	Olive oil Canola oil Safflower oil MCT	Soja Canola oil Milk fat
% Total FA (Weight%)					
MCT	38.5	38.5	38.5	38.5	5.1

SAT[1]	49.0	49.0	52.2	49.0	50.0
18:1n-9	36.8	27.3	27.3	27.3	27.3
n-6 PUFA	10.5	18.5	14.5	21.8	16.0
n-3 PUFA	2.3	4.1	3.2	1.0	3.6
n-6/n-3	4.5	4.5	4.5	21.8	4.5

[1]Includes MCT

Animals and Diets

Five groups (n=10 per group) of Sprague Dawley rats were studied. All animals received basic powder rat chow and water ad libitum for 4 days, prior to being randomly assigned to one of 5 diets (A-E in the table above) containing 15% fat as energy and differing only in their fatty acid composition. The rats were fed their dietary treatment ad libitum prior to (7 days) and post induction (10 days) of sepsis.

The diets were prepared according to the table above and as a powder.

Body weight change Before infection

Small differences in food intake and growth rate were detected by the bootstrap procedure of analyses with higher food intake and gain weight in groups B and C compared to the other groups. However, at day 0, no difference in average body weight was observed.

Body Weight Change After Infection

In all groups, animals exhibited an important body weight loss just after infection (Fig. 13). After that, body weight remained about stable (or tended to slightly decrease) until day 6 after infection. In all groups, we observed a recovery between days 6 and 10 postinfection.

The data strongly suggested beneficial effects of feeding animals diets containing high levels of MCT, in combination with α-linolenic acid (18:3,n-3) as the source of n-3 fatty acid (diets A and B), as compared to all other dietary treatments (C, D and E). The dietary fatty acid composition appeared to have an impact on body weight loss and on the recovery in response to infection.

Animals fed fish oil (Diet C) as a source of the n-3 long-chain polyunsaturated fatty acids, eicosapentaenoic acid (20:5,n-3, EPA) and docosahexaenoic acid (22:6,n-3, DHA), did not exhibit the similar beneficial response compared to animals fed α-linolenic acid (Diets A and B). In addition, replacing long-chain

saturated fatty acids as triglycerides (diet E) for MCT (diet A and B) had an adverse effect on body weight loss and recovery post-infection.

Acute phase proteins

Fibrinogen, α2-macroglobulin and orosomucoïd are positive acute phase proteins. We observed a strong increase in their concentration after infection. This peaked on day 2 for the two later proteins. For fibrinogen concentrations are two times higher than normal on day 2 and 6.

Albumin is a negative acute phase protein: its concentration is depressed after infection (about half the normal range).

The effects of diets differing in their fatty acid compositions on the recovery of rat following sepsis, suggests that a beneficial outcome can be obtained with diets preferably including the following:

a) MCT as a source of energy
b) Low levels of saturated fatty acids (excluding MCT)
c) α-linolenic acid as a source of n-3 fatty acids rather than the LC-PUFA, EPA, DPA, and DHA derived from fish oil
d) A low n-6/n-3 fatty acid ratio
e) A high lipid content

The beneficial effects of the above defined diets included:

a) Attenuated loss of body weight following infection
b) Better growth rate during the recovery phase (groups A and B)
c) Higher food intake (group A and to a lesser extent group B).

Example 3 - Example of product composition

An example of a composition according to the present invention was prepared. Its composition was as follows:

Nutrient	**% Energy**	**g/L or g/1500Kcal**
Protein	18	67.5
Carbohydrate	37	138.8
Lipid	45	75.0
	%wt of total lipid	**g/L**
MCT	50%	37.5

Saturated (include MCT)	57%	42.8
Monounsaturated	31%	23.3
Polyunsaturated	12%	9.0
Linoleic acid (18:2n-6)	9%	6.8
Alpha-linolenic acid (18:3n-3)	3%	2.3
n-6/n-3 ratio	3.0	

The vitamin and mineral content was at least 25% of the RDA.

The caloric density of the composition was 1.5Kcal/ml.

It should be understood that various changes and modifications to the presently preferred embodiments described herein will be apparent to those skilled in the art. Such changes and modifications can be made without departing from the spirit and scope of the present invention and without diminishing its attendant advantages. It is therefore intended that such changes and modifications be covered by the appended claims.

Claims.

1. A composition for use as a medicament, functional food or nutrative product which comprises at least one lipid wherein the lipid provides greater than 35% total energy of the composition.

2. A composition according to claim 1 which comprises about 25% to about 70% MCT (medium chain triglycerides) by weight of total lipid.

3. A composition according to claim 1 or 2 which comprises less than about 15% by weight saturated fatty acids excluding MCT.

4. A composition according to any preceding claim which comprises a n-6/n-3 fatty acid ratio of about 2/1 to 7/1.

5. A composition according to any preceding claim which comprises at least one n-3 fatty acid selected from α-linolenic acid, EPA, DPA or DHA.

6. A composition according to any preceding claim which comprises at least one n-6 fatty acid selected from linoleic acid (18:2,n-6), γ-linolenic acid (18:3, n-6), dihomo-γ-linoleinic acid (18:4, n-6) or arachidonic acid (20:4, n-6).

7. A composition according to any preceding claim for enteral administration which comprises an acceptable carrier, diluent or adjuvant.

8. A method of producing a composition according to any preceding claim having the steps of blending the constituents, liquefying the blended mixture and homogenising.

9. Use of a composition according to any one of claims 1 to 7 for use in the manufacture of a medicament, functional food or nutritive product for the treatment or prevention of sepsis or inflammatory shock.

10. A method of treatment or prevention of sepsis or inflammatory shock which comprises administering an effective amount of a composition according to any one of claims 1 to 7.

Figure 1

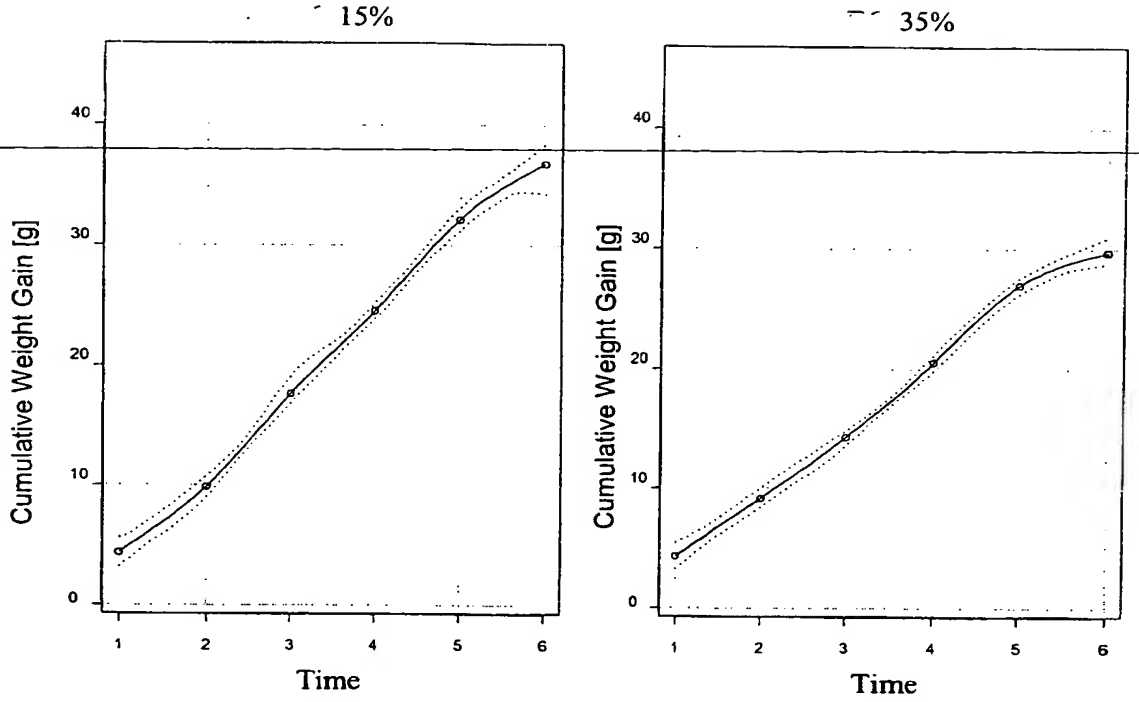


Figure 2

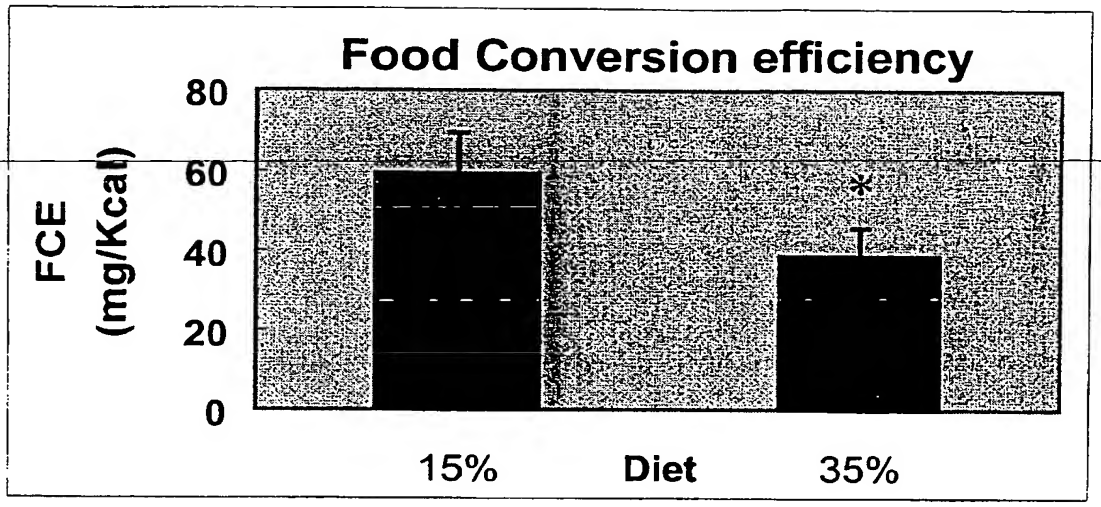

Food Conversion efficiency
FCE (mg/Kcal)
80
60
40
20
0
*
15%
Diet
35%

Figure 3

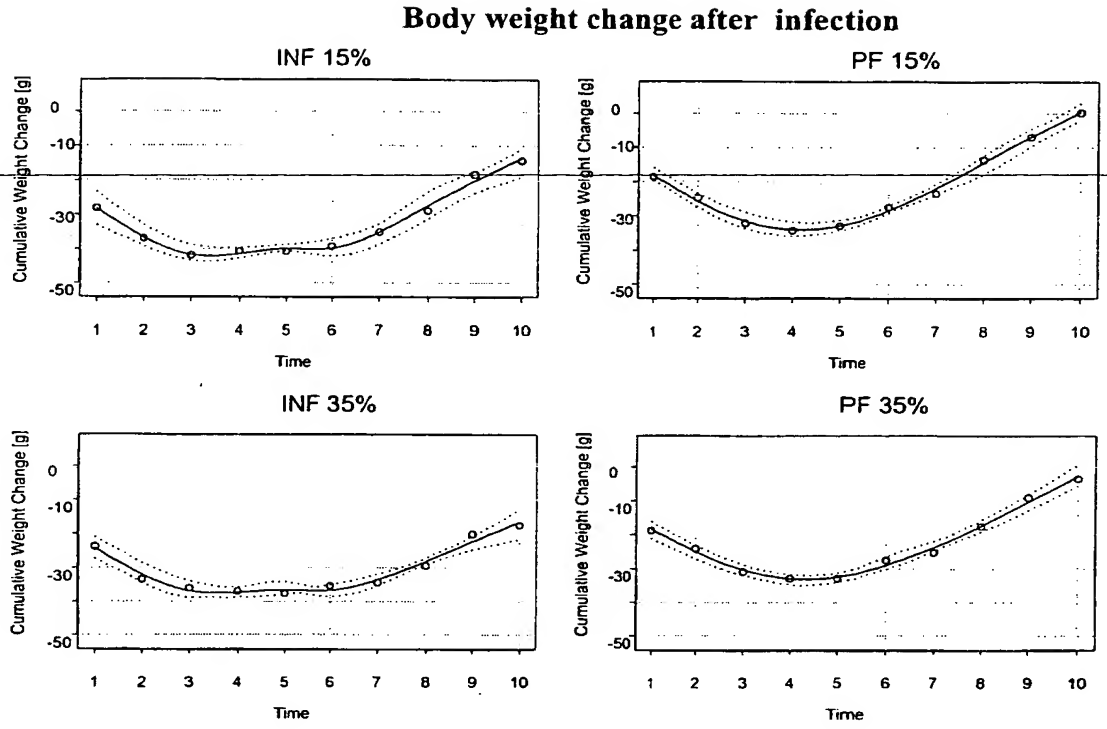

Body weight change after infection
INF 15%
PF 15%
INF 35%
PF 35%
Cumulative Weight Change [g]
0
-10
-30
-50
1 2 3 4 5 6 7 8 9 10
Time

Figure 4

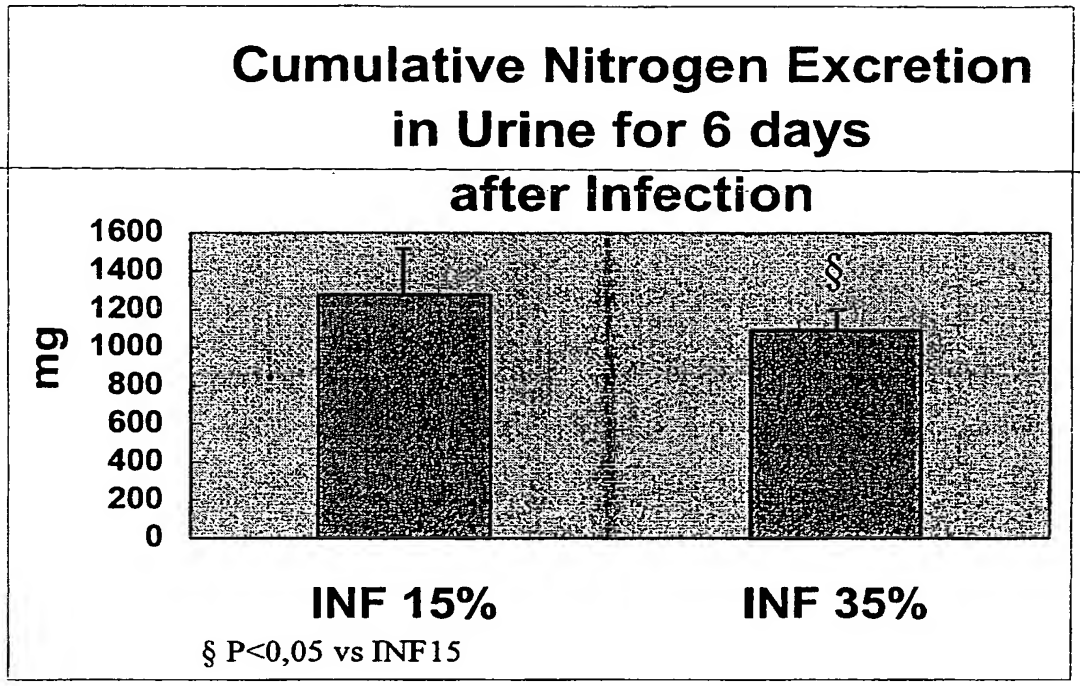

Cumulative Nitrogen Excretion in Urine for 6 days after Infection
mg
1600
1400
1200
1000
800
600
400
200
0
§
INF 15%
INF 35%
§ P<0,05 vs INF15

Figure 5

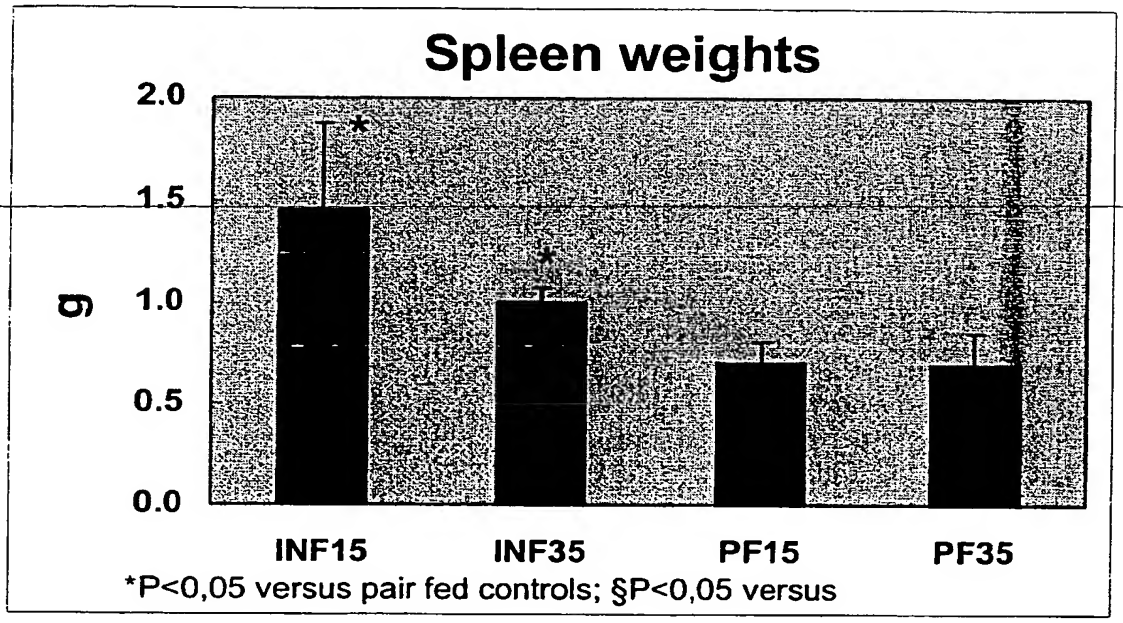

Spleen weights
2.0
1.5
1.0
0.5
0.0
g
*
*
INF15
INF35
PF15
PF35
*P<0,05 versus pair fed controls; §P<0,05 versus

Figure 6

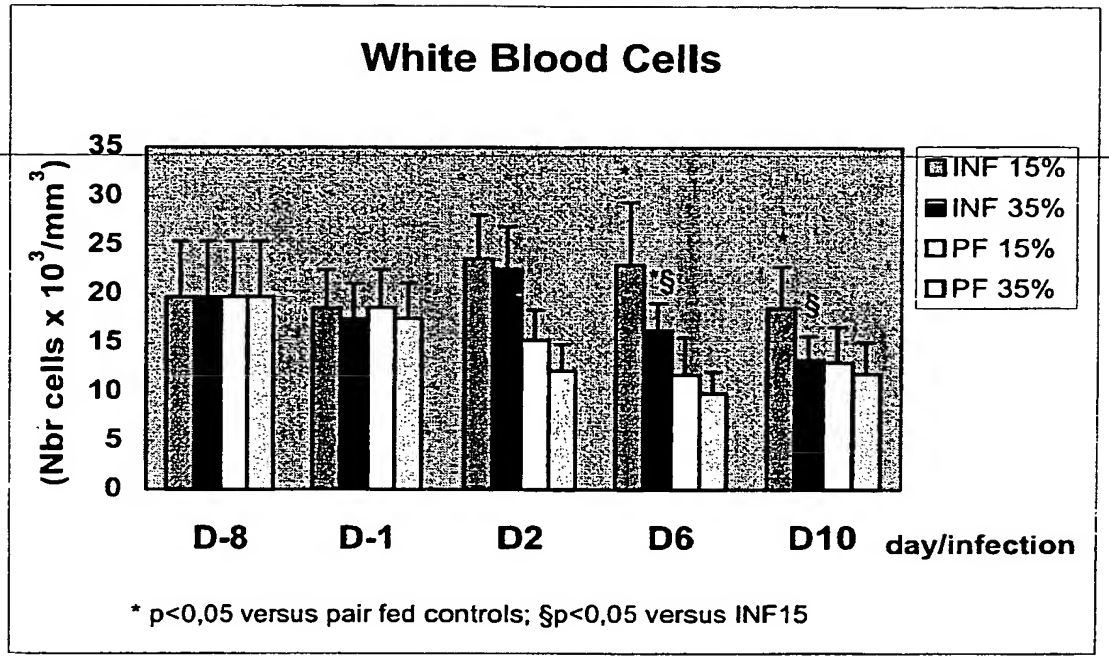

White Blood Cells
(Nbr cells x 10³/mm³)
35
30
25
20
15
10
5
0
INF 15%
INF 35%
PF 15%
PF 35%
*§
§
D-8
D-1
D2
D6
D10
day/infection
* p<0,05 versus pair fed controls; §p<0,05 versus INF15

Figure 7

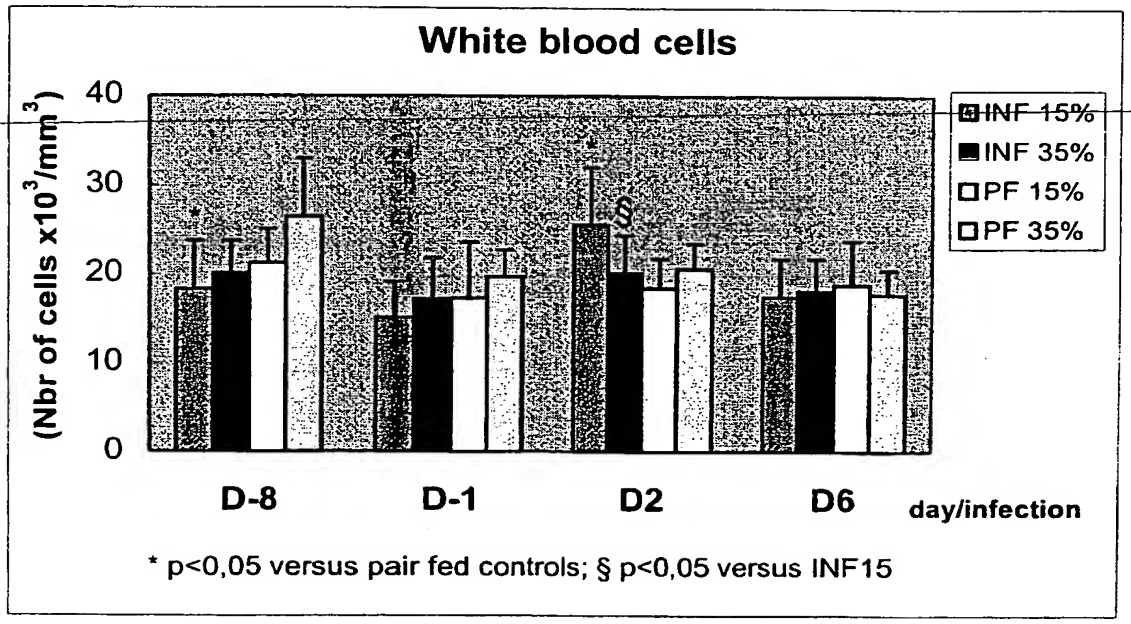

White blood cells
(Nbr of cells x10^3/mm^3)
40
30
20
10
0
INF 15%
INF 35%
PF 15%
PF 35%
*
*
§
D-8
D-1
D2
D6
day/infection
* p<0,05 versus pair fed controls; § p<0,05 versus INF15

Figure 8

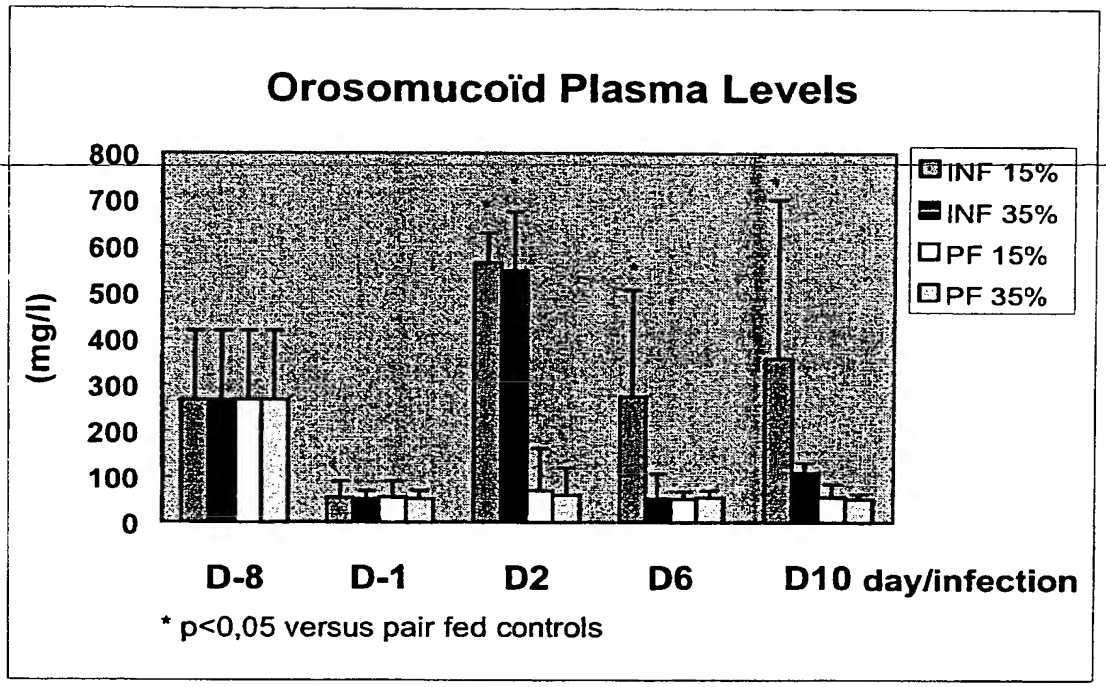

Orosomucoïd Plasma Levels
800
700
600
500
400
300
200
100
0
(mg/l)
INF 15%
INF 35%
PF 15%
PF 35%
D-8
D-1
D2
D6
D10 day/infection
* p<0,05 versus pair fed controls

Figure 9

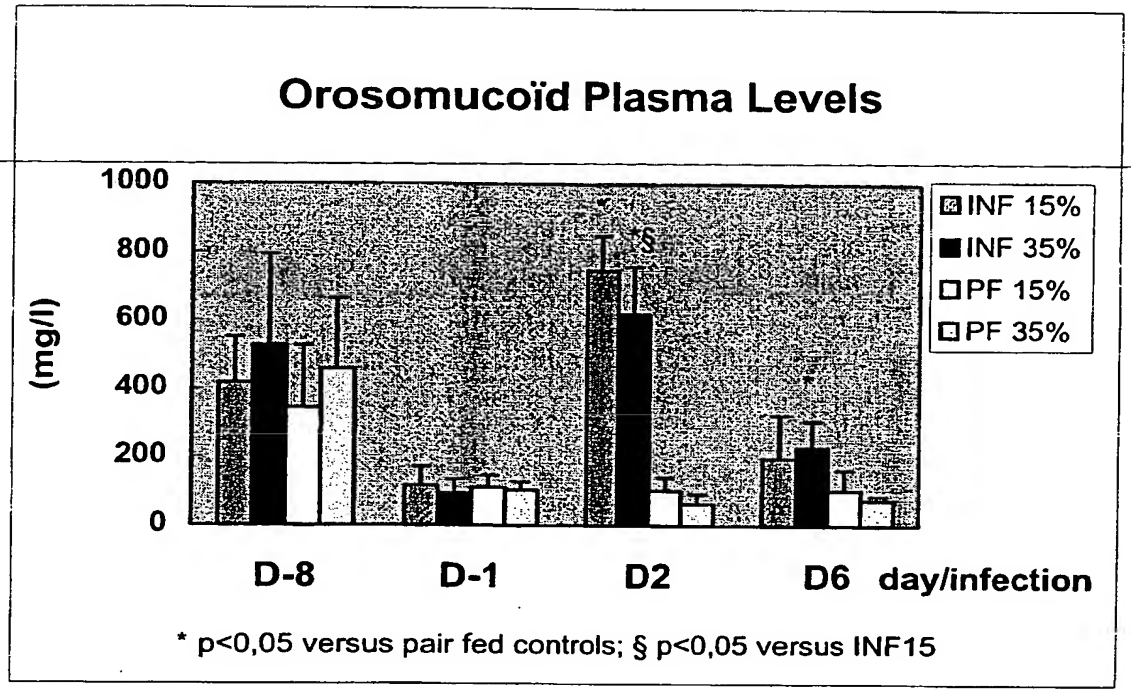

Orosomucoïd Plasma Levels
1000
800
600
400
200
0
(mg/l)
INF 15%
INF 35%
PF 15%
PF 35%
*§
*
D-8
D-1
D2
D6
day/infection
* p<0,05 versus pair fed controls; § p<0,05 versus INF15

Figure 10

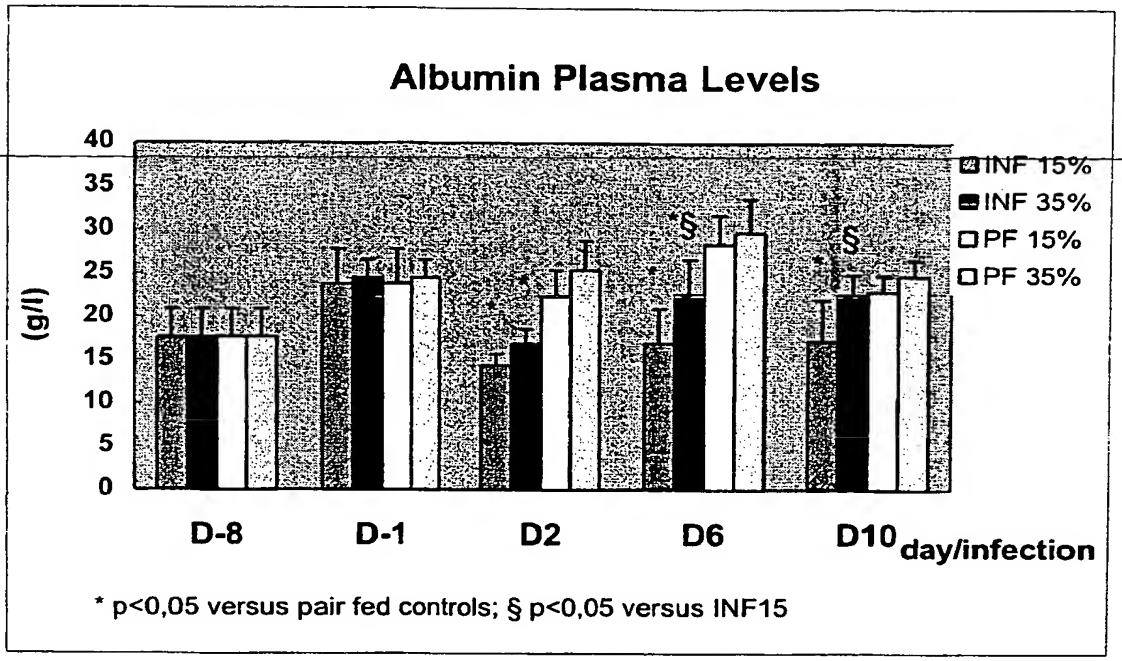

Albumin Plasma Levels
(g/l)
40
35
30
25
20
15
10
5
0
D-8
D-1
D2
D6
D10
day/infection
INF 15%
INF 35%
PF 15%
PF 35%
§
§
* p<0,05 versus pair fed controls; § p<0,05 versus INF15

Figure 11

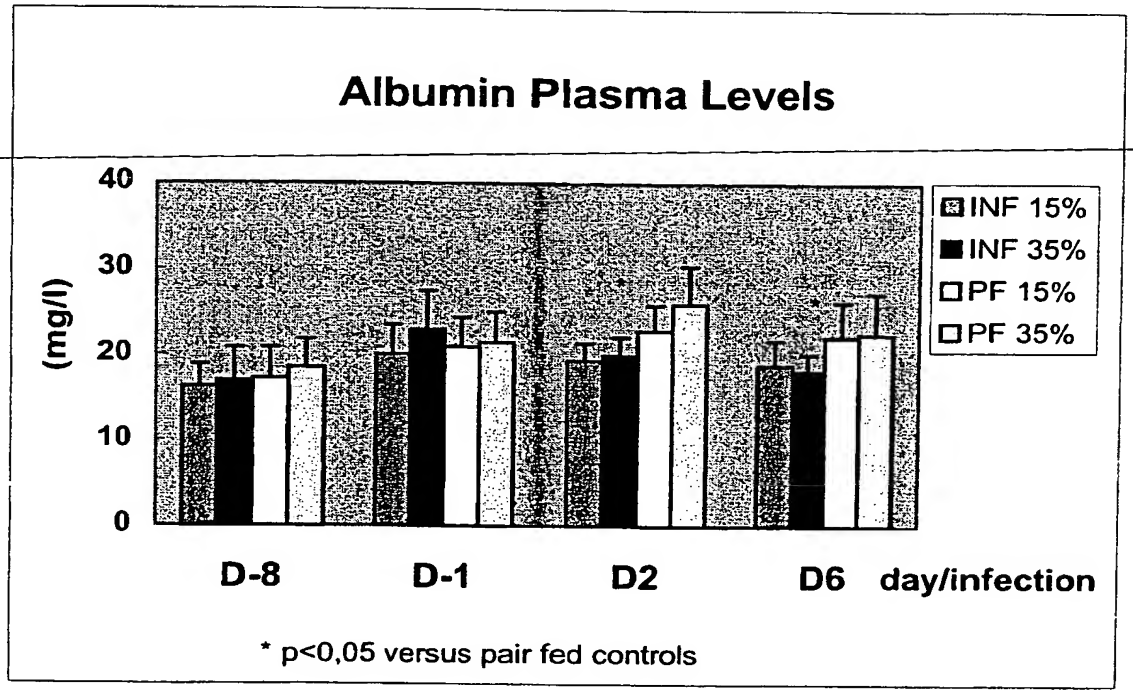

Albumin Plasma Levels
40
30
20
10
0
(mg/l)
INF 15%
INF 35%
PF 15%
PF 35%
D-8
D-1
D2
D6
day/infection
* p<0,05 versus pair fed controls

Figure 12

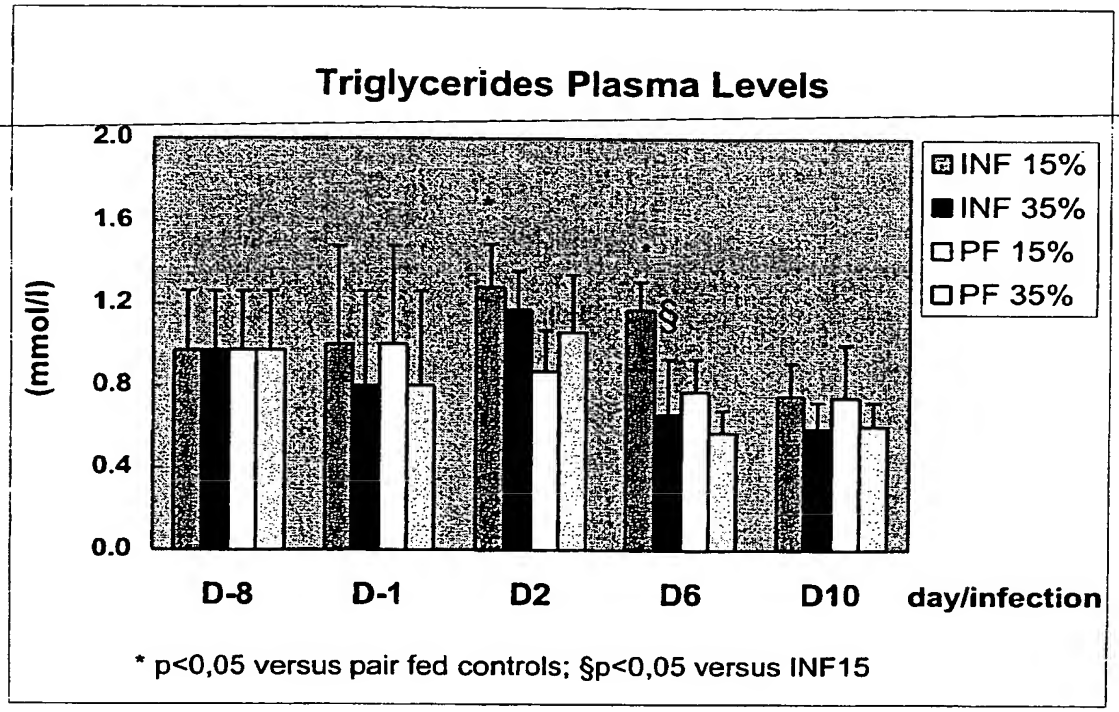
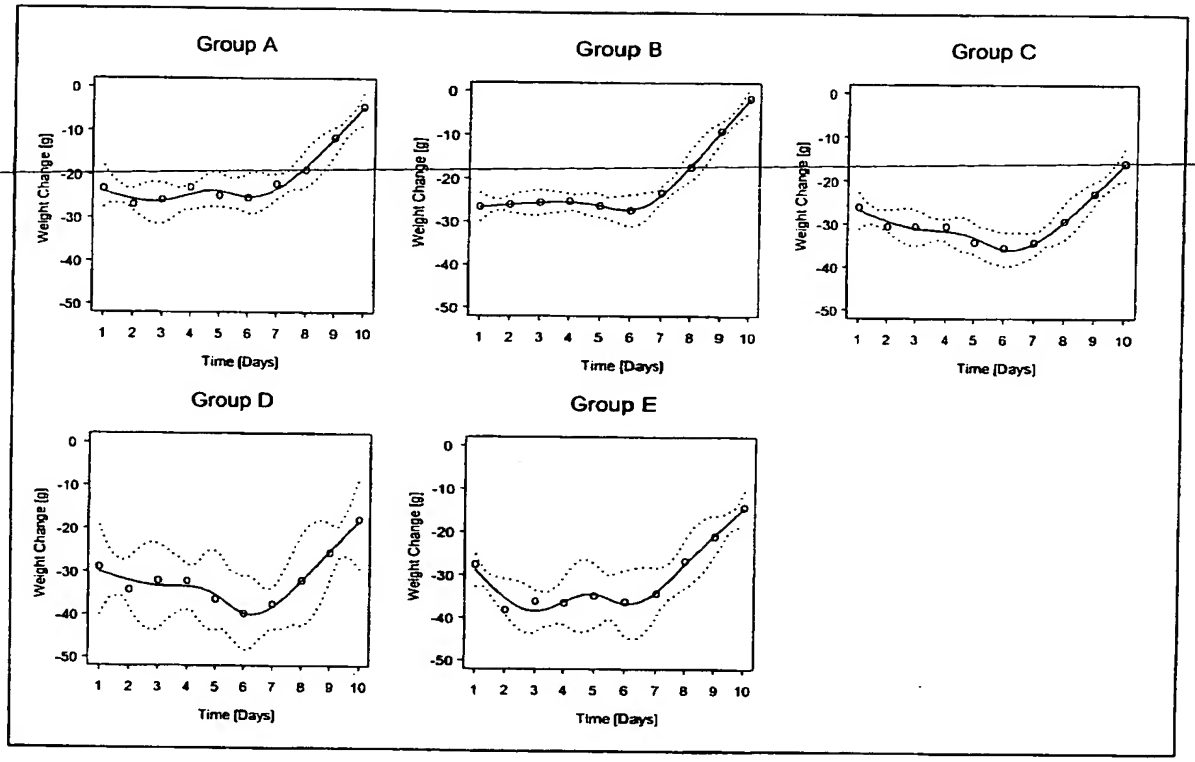

Triglycerides Plasma Levels
2.0
1.6
1.2
0.8
0.4
0.0
(mmol/l)
INF 15%
INF 35%
PF 15%
PF 35%
§
D-8
D-1
D2
D6
D10
day/infection
* p<0,05 versus pair fed controls; §p<0,05 versus INF15

Figure 13


Group A
Group B
Group C
Group D
Group E
Weight Change [g]
Time [Days]
0
-10
-20
-30
-40
-50
1 2 3 4 5 6 7 8 9 10